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QUICK GUIDE to Q.S.M(Quantum Stochstic Mechanics with only Axisom of Quantization Principle):

❶ : Serious Difficuties of Quantum Mechanics lie in "Time and Hamiltonian Structure" :
None can succeed to establish non-equilibrium statistical mechanics as quantum principle,which is essentially due to lack of genuine recoginition on "time".Time in quantum mechanics(=QM) is non-observable,but is quantum statistical variable like as temperature.In QM,physical variable's very important "hermiteness" is equivalent to physical observablity.The difficulty of time in QM is easily proved being nothing quantum state transition under "observable hermitian Hamiltonian≡H_0".That is,$i\hbar\partial_t\Psi=H_0\Psi$ (≡S eqn) is entirely stationary.By the way,QM structure can be constructed from **canonical quantization** on conjugate variables as $[P_j,Q_j]\equiv P_jQ_j-Q_jP_j=i\hbar\,1$,or $\Delta P\Delta Q\geq\frac{1}{2}\hbar$,in which dimension $[\hbar]$=time×energy =[actional].Hence conjugate variable of time "t" is observable Hamiltonian H_0 in which "t" can not be observable.In order to realize quantum state transition,we can not help to introduce non-hermitian Hamiltonian≡$H_S(t)$" where $\Delta E=\infty$ due to "non-observablity of energy" and also $\Delta t=\hbar/\Delta E=0$.
Phenomena of $H_S(t)$ must be **instantaneous quantum state transition** and agree with physical realities.
Schroedinger eqn is generally derived from Quantization Principle(QP) especially as for time and energy.
"QP" can construct any feature of quantum mechanics except interaction force problems.

❷ : Hermite Hamiltonian's Complete Causalityness and Markovian of General Quantum Process :
As H_0 is entirely mathematically regular(≡analytical),so H_0's phenomena must realize entirely causalitical uniquness.This fact can be proved as "unique eigen state realization of H_0's maximum observables P_j" in which $[P_j,H_0]=0$ by using H_0's stationarity $\Delta t=\infty$.Then paradox of Shrodinger's dog is completely resoloved and establish **"quantum process'es complete Markovian feature"** .That is,
"a general quantum sample process becomes series of transitions among H_0's unique eigen state.
In the matter of course,such statistical transitions are caused by $H_S(t)$'s series of the realization.
$H_S(t)$ is non-causalitical(statistical qunatum transition) and is due to "its mathematical singularity" which is entirely reasoable due to Goedel incompleteness theorem and justify being of divergence difficulty in perturbation integral.Hence "renormalization method" becomes final answer in standard theory.

❸ : Stochastic Hamiltonian and its Statistics(Evolution Theorem(or Principle) by Energy Fluctuation) :
After all,in realities,time dependent Hamiltonian becomes **random alternating realization** of H_0 & $H_S(t)$ like as that of "long term conservative regime$\langle H_0\rangle$ and short time revolutional one $\langle H_S(t)\rangle$",so time dependent Schroedinger equation must be stochastic differential one with stochastic Hamiltonian H_R (t).
Hence we must establish statistics of $H_S(t)$,which can be derived as probability density function $\Theta(t)=\Delta E(t)/\hbar$ for realizing spot time duration of $H_S(t)$ on time axis from modified Winer-Kintchin Theorem. $\Delta E(t)$ is statistical deviation of energy in statistical ensemble(**Evolution Theorem by Energy Fluctuation≡ETEF**).Thus necessary tools are almost derived for establishing "Qunatum Stochastic Mechanics".

❹ : Establishing Quantum Stochastic Mechanics and the Problems of Generall Isolated Closed Systems :
Once Markovian had been proved,there must be **Master Equation** as conservation low of probability flow for state transitions.Now $\omega_{jk}(t)$=state j's density,$\Gamma_{jk}(t)$=state transition k→j probability rate.Then $\partial_t\omega_j(t)=\Sigma_k\Gamma_{jk}(t)\omega_k(t)-\Sigma_k\Gamma_{kj}(t)\omega_j(t)\equiv$\{inflow to $|j\rangle$ from $|k\rangle$\}−\{outflow from$|j\rangle$ to $|k\rangle$\}.
$\Gamma_{jk}(t)=\Theta(t)T_{jk}=[\Delta E(t)/\hbar]T_{jk}$ is derived,where T_{jk} is 1st order transition probability by $H_S(t)$.
Finally we derive QSM Master Eqn representing isolated closed thermo-system in statistical ensemble.

(1) $\partial_t\omega_j(t)=\langle\Delta E(t)/\hbar\rangle\Sigma_k[T_{jk}-\delta_{jk}]\omega_k(t)$. ⟨reaction rate$\equiv1/\Delta t(t)=\Delta E(t)/\hbar$: uncertainty of ΔE & Δt⟩

The equation yields following important realities on isolated closed thermo-dynamical system.
(2)irreversibility of the Eqn,(3)entropy increasing low,(4) **general relaxation process solution** which means that any "thermo-chemical reactions" in isolated closed system shall stop their reactions at last.

❺ : The Problems of Generall Opened Systems with Thermo-Chemical External Flows :
The method was generalized to **opened system with thermo-chemical external flows** in the equation (5).Then we derived also (6) **"heat beating solution in constant flows"** by mathematically simplified modeling.

(5) $\partial_t\omega_j(t)=\langle\Delta E_R(t)/\hbar\rangle\Sigma_k[T_{jk}-\delta_{jk}]\omega_k(t)+\langle\Delta E_L(t)/\hbar\rangle\Sigma_k[L_{jk}-\delta_{jk}]\omega_k(t)$

,where $\langle\Delta E_L(t)/\hbar\rangle L_{jk}$ is state transition k→j probability rate caused by "external quantum flow".

Note on Goedel's Completeness Theorem(≡CT)(1928) and Incompleteness Theorem(≡IT)(1930) :

CT : Any deterministic true proposition T in incontradictional theory K(≡axiom system) is provable.
IT : There must be also indeterministic proposition X in incontradictional theory K with N^2T.

☞:Author proved that generally X is probabilitical phenomena caused from singularity in K.So called "chaos" is mere a deterministic sample process of stochastic ensemble.Therefore any proposition must be either deterministic or statistical(≡The Ultra Completeness Theorem≡UCT).Now X in the natural number theory N(≡N^2T) is "the maximum number in N".That is infinity≡∞.Then real number zero≡ 0*=1/∞. Therefore <u>0* is also indeterministic!</u> (∞ and 0* are origin of mathematical singularity).

○ : Quantization Principle on Canonical Conjugate Variable as Fundamental Axiom of Quantum Mechanics :

① : Quantization :

Generally fundamental dynamical structure of Quantum Mechanics(QM) and the standard Quantum Field Theory(QFT) are constituted from Quantization Principle on canonical conjugate variables.$L= L(Q_j, \partial_t Q_j)$ is Lagrangean,then conjugate variable P_j of Q_j is defined as $P_j \equiv \partial L/\partial(\partial_t Q_j)$.Then their quantization is as follows.These algebra define them as quantum numbers or operators.

(1) : $[P_j, Q_k]=i\hbar\delta_{jk}\,1$, (2) : $[P_j, P_k]=[Q_j, Q_k]=0$.

☞ : Relich·Dixmier theorem : such variables $[P_j, Q_j]=i\hbar\,1$ are transformed into $\{P_j=-i\hbar\partial/\partial x_j, Q_j=x_j\}$ by certain unitary transform in general.

② : Deriving Schroedinger Equation :

As for time "t",its has two canonical conjugate variable as {H_0≡Hamiltonian,$i\hbar\partial_t$≡time derivative}. Because $x_\mu=(ict, x_1, x_2, x_3)$ and $p_\mu=\{iE/c, p_1, p_2, p_3\}=-i\hbar\partial_\mu$.Hence $E=(c/i)(-i\hbar\partial/\partial x_0)=(c/i)(-i\hbar\partial/ic\partial t)$ $=i\hbar\partial/\partial t$.Then $H_0=i\hbar\partial_t$ for any functions?.Absolutely no.Unique possibility is $H_0=i\hbar\partial_t$ for certain function Ψ.That is $i\hbar\partial_t\Psi=H_0\Psi$. ·····(1)

③ : Uncertainty Theorem for Canonical Conjugate Variable $[P_j, Q_j]=i\hbar 1$:

Then we can prove following inequality in which $\Delta P_j, \Delta Q_j$ are statistical deviation.

$\Delta P_j\cdot\Delta Q_j \geqq \frac{1}{2}\hbar$ ·······(1)

☞ : As for time and energy,it is rather complicated to derive.The result is $\Delta E\cdot\Delta t=\hbar$.····(2).
(2) is derived from modified Winer·Kintchin theorem as evolution theorem by energy fluctuation.
Then ΔE is statistical deviation of concerned system and Δt is average reaction time.See → ❸.

❶ : Serious Difficuties of Quantum Mechanics lie in "Time and Hamiltonian Structure" :

① Observable Hermitian Operator's Spectral Representation :

(1)General linear operator A in function space : {|r⟩≡orthogonal function set. ⟨r|s⟩= δ(r−s)}

$A\,|r\rangle=\int ds\cdot a_{sr}|s\rangle=\int ds\int dt\cdot a_{st}|s\rangle\langle t|r\rangle. \rightarrow A=\int ds\int dt\cdot a_{st}|s\rangle\langle t|.$

(2)General hermite operator :

$\langle s|\,A\,|r\rangle=\langle r|\,A\,|s\rangle^*=a_{sr}=a^*_{rs}$. ⟨diagonalizationability by Unitary transform U ⟩.

(3)spectral representation of hermite operator : $\langle(\int ds\cdot U_{ps}a_{st})\equiv A_p\delta(p-t) : A_p=\text{real number}\rangle$

$A' \equiv U\cdot A=\int dp\int dq\cdot U_{pq}|p\rangle\langle q|\times\int ds\int dt\cdot a_{st}|s\rangle\langle t|=\int dp\int dt\cdot\int ds U_{ps}a_{st}|p\rangle\langle t|=\int dp\int dt\cdot A_p\delta(p-t)|p\rangle\langle t|$
$=\int dp A_p|p\rangle\langle p|.$

② H_0≡hermitian Hamiltonian's Stationality and the Causalitical Uniqueness :

After all,simuletaneous determination on "time ane energy" is impossible due to uncertainty of 0 ③(2). Therefore H(t) of time dependent Hamiltonian never can be deterministic one.Thus causalitica form of time dependent theory becomes impossible in quantume theory in general.Unfortunately this serious facts has been neglected to cause serious difficulties in various aspects of quantum physics.

<u>Nothing quantum state transition by hermitian Hamiltonian H_0</u>.That is,absolutely stationary!.And also under hermite Hamiltonian,realizable quantum state must be unique eigen one in its maximum observable. So called "superpositional state of H_0's eigen ones are forbidden in general".Hence famous paradox of Shchroedinger dog is resolved.Though such as for position variable of non maximum observable of H_0, superpositional state of the variable's eigen state is realized.After all,the uniqueness feature ensures generall quantum process'es Markovian nature and enable establishing Quantum Stochastic Mechanics.

(1) **"Nothing Quantum State Transition Under Hermitian Hamiltonian$\equiv H_0$:**

$H_0=\int d\varepsilon|\varepsilon\rangle\langle\varepsilon|$; $\psi=\int d\varepsilon a(t;\varepsilon)|\varepsilon\rangle$. $\rightarrow$ $i\hbar\partial_t\psi=H_0\psi$. $\rightarrow a(t;\varepsilon)=a(0;\varepsilon)e^{\varepsilon t/i\hbar}$.

$\rightarrow$ $\psi=\int d\varepsilon a(0;\varepsilon)e^{\varepsilon t/i\hbar}|\varepsilon\rangle$. $\rightarrow$ $\partial_t|a(0;\varepsilon)e^{\varepsilon t/i\hbar}|^2=0$. $\rightarrow$ "nothing quantum state transition"

(2) **"Unique Energy Eigen State Realization of H_0" :**

{stationarity $\Leftrightarrow$ $\Delta t=\infty$}. $\rightarrow$ $\Delta E=0$. "unique energy eigen state realization of H_0".

In the below, it is also proved that degeneration in energy state is discriminated by other qunatum numbers

❷ : Hermite Hamiltonian's Complete Causalityness and Markovian of General Quantum Process :

(1)"Realization of unique eigen state of maximum observable P_r of H_0" : (☞ : $H_0|j\rangle=\varepsilon^j|j\rangle$).

Maximum observable of $H_0\equiv\{\ P_r\ \ |\ [\ P_r\ ,\ \ H_0]=0\ ;r=1,2,\cdots,M\}$. ·······(1)-1.

Now we prove $\Delta P_r=0$ due to $\infty=\Delta Q_r$, $\Delta P_r=\hbar/\Delta Q_r$, where Q_r is canonical conjugate of P_r .

$[\ Q_r,P_r\ ]=i\hbar\ 1$. $\rightarrow$ $i\hbar\partial_t\ Q_r\ =[\ Q_r\ ,H_0]\neq 0$. ·······(1)-2.

Such Q_r is time dependent in $\Delta t=\infty$ of H_0. Hence if $q_r=q_r(t)$ is definete, $t=q_r^{-1}(q_r)$ must be also definite. This contradicts with indefiniteness of time as $\Delta t=\infty$ in H_0 system. Hence $\Delta Q_r=\infty$.

{stationarity $\Leftrightarrow$ $\Delta t=\infty$}. $\rightarrow$ $\Delta P_r=0$. "unique eigen state realization of H_0's maximum observable P_r ". $i\hbar\partial_t\Psi=H_0\Psi$. $\Leftrightarrow$ {$\Psi=|\varepsilon^j;p_1{}^j,p_2{}^j,\cdots,p_M{}^j\rangle$ is unique eigen state under hermitian Hamiltonian H_0}

(2) **Mathematical Singularity of Time Dependent Hamiltonian$\equiv H_S(t)$:**

As the logical nagation, Hamiltonian of causing state transition must be **non-hermite.** Then non-hermiteness must be **non-observability of energy** , that is $\Delta E=\infty$, which causes $\Delta t=0$ for non-hermite Hamiltonian. In anyway such Hamiltonian never can be mathematically regular(non analytical=singular). Hence the phenomena of $H_S(t)$($\equiv$non-hermite singular Hamiltonian) never can be causalitical. As its realities, observed quantum transitions are instantaneous phenomena($\Delta t=0$) with certain probability($\equiv$non-causality).

Thus $H_S(t)$ shall cause quantum transition with certain probability in its duration $\Delta t=0$ on time axis. Then when time spot phenomenon of $H_S(t)$ shall realize becomes serious problem.$\rightarrow$ (4).

example 1) $H_{GF}=\int\int dx^3[gc\hbar\bar{\psi}(x)\gamma^\mu A^a{}_\mu(x)\ G_a\ \psi(x)]$ is called minimal guage interaction of spinor field ψ and guage field $A^a{}_\mu(x)$ which are mathematically called "hyper function by Satoh(or distribution by Schwarz)" due to Dirac's delta function in field commutation relation. Then $\psi\times A^a{}_\mu$ product with common field parameter$\equiv$x never mathematically defined in general. That is breakdown of "regularity". As is well-known, physics of H_{GF} is probabilitical on its reactions in perturbation integral.

(3) **Markovian Nature of General Quantum Process :**

As the logic, general quantum process must be time serie of alternating realization of {H_0 & $H_S(t)$}. Hence realizable sample process must be also series of instantaneous probabilitical transitions among H_0's eigen states. This is nothing without Markov Process of quantum one.$\rightarrow$ Quantum Stochastic Mechanics.

❸ : Stochastic Hamiltonian and its Statistics(Evolution Theorem(or Principle) by Energy Fluctuation) :

① Fundamental idea=corelation function of $\Psi(t)$ as mesure of initial state decay caused by $H_S(t)$.

As was mentioned, time dependent Hamiltonian $H_R(t)$ becomes **random alternating realization** of H_0 & $H_S(t)$

Now we shall establish statistics of $H_S(t)$, of which effects should refelect on statistics on decay of initial state $\Psi(t)=\int dq\cdot a_q(t)|q\rangle$ to $\Psi(t+\Delta t)$, where $|a_q(t)|^2\equiv\omega_q(t)$ is state density of $|q\rangle$. Because the variation of $a_q(t)$ is caused from realization of $H_S(t)$. The mesure becomes corelation function between $\Psi(t)$ and $\Psi(t+\Delta t)$. Now we introduce "Modified Winer Kintchin Theorem" in corelation functiony and spectrum density. The modification is taken for the time integration interval which is finite in macrosopic view point, however it is sufficient to be infinitive in microscopic quantum view point.

② Modified Winer Kintchin Theorem and Evolution Theorem by Energy Fluctuation($\equiv$ETEF) :

(1)Semi·macrosopic integral time duration : $T(t)\equiv[t-\frac{1}{2}□T,\ t+\frac{1}{2}□T]$, where $□T\gg\Delta t=\hbar/\Delta\varepsilon$.

(2)Fourier component of $\Psi(t)$: $c(\varepsilon;t)\equiv(2\pi\hbar)^{-\frac{1}{2}}\int_{T(t)}du|\Psi(u)\rangle\exp(\varepsilon u/i\hbar)$.

(3)State density : $\omega(\varepsilon;t)\equiv\langle c(\varepsilon;t)|c(\varepsilon;t)\rangle/□T=□T^{-1}(2\pi\hbar)^{-1}\int_{T(t)}du\int_{T(t)}dv\langle\Psi(u)|\Psi(v)\rangle\exp[-\varepsilon(u-v)/i\hbar]$.

(4)Inverse Fourier : $\int_{-\infty}^{\infty}d\varepsilon\exp(-\varepsilon\Delta u/i\hbar)\omega(\varepsilon;t)=$

transform $=□T^{-1}(2\pi\hbar)^{-1}\int_{T(t)}du\int_{T(t)}dv\langle\Psi(u)|\Psi(v)\rangle\int_{-\infty}^{\infty}d\varepsilon\exp(-\varepsilon(\Delta u+u-v)/i\hbar]$

$=□T^{-1}\int_{T(t)}du\int_{T(t)}dv\langle\Psi(u)|\Psi(v)\rangle\delta(\Delta u+u-v)=□T^{-1}\int_{T(t)}du\langle\Psi(u)|\Psi(u+\Delta u)\rangle\equiv\Upsilon(\Delta u;t)$.

(5) $\Upsilon(\Delta u;t)=\int_{-\infty}^{\infty}d\varepsilon\exp(-\varepsilon\Delta u/i\hbar)\omega(\varepsilon;t)=1+i\langle\varepsilon\rangle\Delta u/\hbar-\frac{1}{2}\langle\varepsilon^2\rangle\Delta u^2/\hbar^2+\cdots\cdots$

(6) $|\Upsilon(\Delta u;t)|=1-\Delta\varepsilon\Delta u/\hbar+\cdots\cdots=$ **non-decaying probability of initial $\Psi(t)$ by $H_S(t)$.**

where $\Delta\varepsilon(t)=\sqrt{(\langle\varepsilon^2\rangle-\langle\varepsilon\rangle^2)}$ is statistical deviation of energy by $\omega(\varepsilon;t)$. $\langle\varepsilon^n\rangle=\int d\varepsilon\cdot\varepsilon^n\omega(\varepsilon;t)$.

— EVOLUTION THEOREM[*] BY ENERGY FLUCTUTION — ⟨*: or principle⟩

(7): $\Theta(t)=\Delta\varepsilon(t)/\hbar$: probability rate of generationg $H_s(t)$ causing Ψ's decay(state transition).
(8): $\Delta\varepsilon^2=\langle\varepsilon^2\rangle-\langle\varepsilon\rangle^2$: energy deviation in state density $\omega(\varepsilon;t)$.
(9): $\Delta\varepsilon\Delta t=\hbar$. : uncertainty theorem for time and energy.
(10): $\Delta t=\hbar/\Delta\varepsilon$: average duration of H_0, or average rate time of generationg $H_s(t)$.

❹: Establishing Quantum Stochastic Mechanics and the Problems of Generall Isolated Closed Systems:

①Markov process ⇔ $\partial_t\omega_j(t)=\Sigma_k\Gamma_{jk}(t)\omega_k(t)-\Sigma_k\Gamma_{kj}(t)\omega_j(t)$. ⟨ **Master equation** ⟩.
②Transition probability rate $\Gamma_{jk}(t)=\Theta(t)T_{jk}=[\Delta E(t)/\hbar]T_{jk}$.
(1)1st order transition probability by $H_s(t)$: $T_{jk}=|(i\hbar)\int_U dt\langle j|H_s(t)|k\rangle|^2$. ⟨☞: U is not known⟩
To tell frankly, concrete details of T_{jk} has not been surveyed yet. According to perturbation integral method in QFT, coordinate x dependent term in the integral is $\int_U dx^4\exp[(p^f{}_\mu-p^i{}_\mu)x_\mu/i\hbar]=(2\pi\hbar)^4\delta(p^f{}_\mu-p^i{}_\mu)$, where U=[-∞;∞]. This represent 4dimensional momentum conservation low for $|i\rangle\to|f\rangle$ in U.
Therefore T_{jk} dominant term may be other constant term such as "function of momentum space variables".
(2)See ⑥(6). There is a possibility of deriving T from final equilibrium state≡ ω^∞, where $T\omega^\infty=\omega^\infty$.
(3)In view point of Goedel theorems, there must be algorithm on T_{jk}. Because a probabilitical theorem itself is an unique deterministic describtion. There never be breaking down of uniqueness of theory.

③ $\partial_t\omega_j(t)=\langle\Delta E(t)/\hbar\rangle\Sigma_k[T_{jk}-\delta_{jk}]\omega_k(t)$. ⟨reaction rate≡$1/\Delta t(t)=\Delta E(t)/\hbar$: uncertainty of ΔE & Δt⟩
$\partial_t\,\omega(t)=\langle\Delta E(t)/\hbar\rangle\,[T-1]\omega(t)$.

The equation yields following important realities on isolated closed thermo-dynamical system.
④ **Irreversibility of the Eqn:** proof) $t\to(-t)$ is not invariant for form of the equation.
⑤ **Entropy Increasing Low:** proof) $S\equiv k_B\Sigma\omega_j\ln(1/\omega_j)$.
$\partial_t S(t)=\frac{1}{2}k_B\Theta\Sigma_{j,k}(T_{kj}\omega_j-T_{jk}\omega_k)(\ln\omega_j-\ln\omega_k)\geq 0$. ← $(T_{kj}=T_{kj})$.

⑥ **General Relaxation Process Solution in Isolated Closed System:**
(1)Markov chain expansion solution: $\omega=\Sigma_{n=0}^{\infty}R_n(t)\ T^n\omega_0$. ⟨ $\omega_0\equiv\omega_0(0)$: initial state density⟩
(2)$R_n(t)$ is the probability of realization of "n th order reaction at time=t".
$R_n(t)\geq 0$, $1=\Sigma_{n=0}^{\infty}R_n(t)$. ⇒ (5): **domino -propagation of peak value R_n(n=0→1→2→3→‥‥).**
(3)→ $0=\partial_t R_0+\Theta R_0$. ⇒ $R_0=\exp[-\int_0^t du\Theta(u)]$.
→ $0=\partial_t R_{n+1}+\Theta R_{n+1}=\Theta R_n$. ⇒ $R_n=\int_0^t du\Theta(u)R_{n-1}(u)\exp[-\int_0^{t-u}ds\Theta(s)]$. ⟨n=1,2,3,‥‥⟩.
(4)$R_0(t)$ is monotonous decreasing function from 1 at t=0.
(5)$\partial_t R_{n+1}=\Theta(R_n-R_{n+1})$: ⟨note that $\Theta>0$⟩
R_{n+1} shall increase from zero and to have single maximum point at $R_n(\searrow)=R_{n+1}(\nearrow)$, then becomes monotonously decreasing function toward zero due to $(R_n-R_{n+1})<0$.
(6)$R_n(\infty)\to+0$. ⇒ **$T\omega(\infty)=\omega(\infty)$ ⇒ equibrium state=general relaxation process.**
☞: In (6), there is a possibitility of deriving T from wellknown equibrium state= $\omega(\infty)\equiv\omega^\infty$.
Because $0=\Sigma_k T^{(j)}{}_k\omega^\infty{}_k$, hence vector ω^∞ is orthogonal to $T^{(j)}$, where $T^{(j)}{}_k\equiv T_{jk}$.

❺: The Problems of Generall Opened Systems with Thermo-Chemical External Flows:
①State transition is caused also by in & out thermo-chemical flow at boundary of the system, which is equivalent to being another singular Hamiltonian≡ $J_s(t)$ like as $H_s(t)$. Then we assume probabilitical exclusiveness as follows. $\Gamma_{jk}(t)\equiv\Gamma^I{}_{jk}(t)+\Gamma^E{}_{jk}(t)=\Theta(t)T_{jk}+\Lambda(t)L_{jk}$. ‥‥(1)

(2) $\partial_t\omega_j(t)=\langle\Delta\varepsilon_R(t)/\hbar\rangle\Sigma_k[T_{jk}-\delta_{jk}]\omega_k(t)+\langle\Delta\zeta_L(t)/\hbar\rangle\Sigma_k[L_{jk}-\delta_{jk}]\omega_k(t)$. ‥‥ **opened system eqn.**
(3) $\Delta\zeta_L(t)=\sqrt{\{\Sigma_{j,k}{}^{\infty}L_{jk}(t)\omega_k(t)(\varepsilon_j-\langle\varepsilon\rangle)^2}$. : Energy deviation caused by flowing transition L_{jk}.

② **Simple model solution≡virtual stationaly flow and heart beating solution: $j_0\equiv\Lambda(t)[L-1]\omega(t)$⟩.**
(1)$\partial_t\,\omega=\Theta\,[T-1]\omega+j_0$; $\omega\equiv\Sigma_{n=0}^{\infty}R_n(t)\ T^n\omega_0+\Sigma_{m=0}^{\infty}F_m(t)\ T^m j_0$.
$0=\partial_t R_0+\Theta R_0$; $0=\partial_t R_{n+1}-\Theta(R_n-R_{n+1})$; $0=(\partial_t F_0+\Theta F_0-1)$; $0=\partial_t F_m-\Theta(F_{m-1}-F_m)$.
(2)R_n behaves the same as one in isolated closed system. ⇒ $R_n(\infty)=0$.
(3)$0=\partial_t F_0+\Theta F_0-1$. ⇒ $F_0(t)=\exp\langle-\int_0^t ds\Theta(s)\rangle\int_0^t du\exp[\int_0^u ds\Theta(s)]\geq 0$.
$0=\partial_t F_m-\Theta(F_{m-1}-F_m)$. ⇒ $F_m(t)=\int_0^t du\Theta(u)\rangle F_{m-1}(u)\exp[-\int_0^{t-u}ds\Theta(s)]\geq 0$.
(4)$\partial_t F_m(\infty)=0$. → $\{F_m(\infty)=1/\Theta(\infty)=\Delta t(\infty)$; (2)} ⇒ $0=\partial_t\,\omega(\infty)=\Theta(\infty)\,[T-1]\omega(\infty)+j_0$.

(5) $\omega(\infty)=T\omega(\infty)+\Delta t(\infty)\,j_0$. : **⟨solution of heart beating with stationary flow⟩.**
$\omega(\infty)=\Delta t(\infty)\,[1-T]^{-1}\cdot j_0$. : **⟨equibrium state determined by flow j_0 and T ⟩.**

● **The Fundamental Axioms of Quantum Mechanics (as trial rough proposal):**

A0 : any observable physical variable is represented by hermitian operator **A** and observed value is their eigen value a_p with "eigen state function" $\psi=|a_p\rangle$. → **A** $|a_p\rangle=a_p|a_p\rangle$. 〈 **eigen equation** 〉

A1 : clasical(≡non-qunatized) mechanical system of Lagrangean $L(Q_j,\partial_t Q_j)$ is quantized by **Canonical Quantization Principle(≡CQP)** on physical variables as hermite operator as follows.
$P_j\equiv\partial L/\partial(\partial_t Q_j)$.→ $[Q_j,P_k]\equiv Q_jP_k-P_kQ_j=i\hbar\delta_{jk}1$.
$[Q_j,Q_k]=[P_j,P_k]=0$.

☞ : The principle determing clasical field Lagragean are (1)global Lorentz covariance,(2)localized Lorentz one.(1) is for free spinor field Lagrangean,and (2) is for quantum gravitational Lagrangean of unified field.They are unifiedly called "Transform Invariance Principle(≡TIP)".

Theorem1 : Observed value is expressed as $a_p=\langle a_p|$ **A** $|a_p\rangle$.

T2 : Commutable observables has common eigen function and "enables simuletaneous observation".
proof) $0\equiv[A,B]$.→ $B=F(A)$.→ $B|a_p\rangle=F(a_p)|a_p\rangle$.
☞;If $A=H_0$, B is MO≡maximum observable.

T3 : Eigen functions becomes complete ortho-normal function set.
Any function $|c_q\rangle$ can be expressed its expansion form as $|c_q\rangle=\int dp\cdot u_{qp}|a_p\rangle$.
→ $1\equiv\langle a_p|a_p\rangle=\int dq\int dq'\cdot u_{pq'}{}^*\cdot u_{pq}\langle c_{q'}|c_q\rangle=\int dq\int dq'\cdot u_{pq'}{}^*\cdot u_{pq}\delta(q'-q)=\int dq|u_{pq}|^2$.
Hence $\{|u_{pq}|^2\}$ has "probability feature".

T4 : Simuletaneous observation on state $|a_p\rangle$ by non-commutable observable **C** never can yield unique
p "deterministic results",but yield statistical results〈 **Breakdown of causality in non-MO observation**〉
r **C** $|c_q\rangle=c_q|c_q\rangle$. → expansion therem → $|a_p\rangle=\int dq\cdot v_{pq}|c_q\rangle$.
o → Observed value(T1)$=\langle a_p|$ **C** $|a_p\rangle=\int dq'\int dq\cdot v_{pq}\cdot v_{pq'}{}^*c_q\langle c_{q'}|c_q\rangle=\int dq\cdot|v_{pq}|^2c_q$.
o From axiom A0,each sample observation value must be eigen value c_q.However observed value(T1) has
f averaged value form with probability density $|v_{pq}|^2$.Therefore causality uniqueness of non-commutable observation is broken down and is to ensure "statistical interpretation".
☞ : See Goedel Incompleteness theorem.

In this way,in our quantum mechanics,introducing probability is not an axiom,but is a theorem.

T5 : Non-commutable observation is a irreversible reaction on initial state$|a_p\rangle$ into $|c_q\rangle$.
The irreversibility is evident by entropy increasing $S=k_b\int dq\cdot|v_{pq}|\ln(1/|v_{pq}|)>0$.
☞ : $\psi=\psi(p;x)$ is assumed to be a momentum eigen function.If we try particles position observation,then $\psi=\int dx'\psi(p;x')\delta(x-x')$ → $\delta(x-x')$ of particle position x' with the probability density$=|\psi(p;x')|^2$
In the reality,$\psi\to\delta$ is a reaction by external injection of test particle for observation.

EXT6 : Relich·Dixmier theorem : such variables $[P_j,Q_j]=i\hbar 1$ are transformed into $\{P_j=-i\hbar\partial/\partial x_j,Q_j=x_j\}$ by certain unitary transform in general.

T7$^{\sigma)}$: Deriving Schroedinger equation from CQP :
As for time "t",its has two canonical conjugate variable as $\{H_0$≡Hamiltonian,$i\hbar\partial_t$≡time derivative$\}$.
due to dimension analysis in CQP.
Because $x_\mu=(ict,x_1,x_2,x_3)$ and $p_\mu=\{iE/c,p_1,p_2,p_3\}=-i\hbar\partial_\mu$〈EXT6 and external theory of relativity〉.
Hence $E=(c/i)(-i\hbar\partial/\partial x_0)=(c/i)(-i\hbar\partial/ic\partial t)=i\hbar\partial/\partial t$.Then $H_0=i\hbar\partial_t$ for any functions?.Absolutely no!.
Unique possibility is $H_0=i\hbar\partial_t$ for certain function Ψ.That is $i\hbar\partial_t\Psi=H_0\Psi$.
☞ : Certainly "theory of relativity is out of this axiom system",however in unified principles with TIP,it may can be closed?.

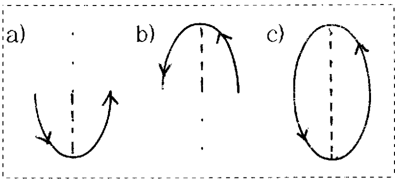
T8 : Uncertainty Theorem for Canonical Conjugate Variable $[P_j,Q_j]=i\hbar 1$:
Then we can prove following inequality in which $\Delta P_j,\Delta Q_j$ are statistical deviation.
$\Delta P_j\cdot\Delta Q_j\geq\frac{1}{2}\hbar$.

T9 : As for time and energy,it is rather complicated to derive.The result is $\Delta E\cdot\Delta t=\hbar$.

❷ **−Diffraction Pattern Forming by Single Eectron Beam's Accumulation throgh Two Slits−**

After all,single electron of constant momentum can go through two silits simuletaneously by "random instantaneous space transportation of electron" through higher order vaccume polarization reactions. A free running elementary particle never be free,but is also a consequence with vaccume field reactions. Because quantum vaccume field is supremely filled with vaccume polarization reactiosn at anywhere.

(1)A quantum vaccume field is not empty but is filled with vaccume polarization reactions of anykind of spinor elementary particles pairs in any space and any time.Such reactions are caused frome H_{GF}.



$H_{GF}=gc\hbar\overline{\psi}\gamma^{\mu}A^{a}_{\mu}G_{a}\psi$. 〈minimal guage interaction〉

$\overline{\psi}(x)=\Sigma_s\int dp^N\{\ b(p,s)\ \overline{v}(p,s)e^{-px/i\hbar}+a^{+}(p,s)\ \overline{u}(p,s)e^{px/i\hbar}\}$.

$\psi(x)=\Sigma_s\int dp^N\{\ a(p,s)\ u(p,s)e^{-px/i\hbar}+b^{+}(p,s)\ v(p,s)e^{px/i\hbar}\}$.

$A^{a}_{\mu}(x)=\Sigma_\lambda\int dq^N\{\ c^{a}(q,\lambda)\ \varepsilon_\mu(q,\lambda)e^{-qx/i\hbar}+c^{a+}(q,\lambda)\ \varepsilon_\mu(q,\lambda)e^{qx/i\hbar}\}$.

Consequnetly 8 kind of 1st order reactions are derived from H_{GF}.Any kind of higher order quantum field reactions are time series of each 8 kind of fundamental reactions.Especially vaccum polarization creation a) and vaccume polarization anihilation b) are fundamental.c) is sequential reaction of a)→b) as closed vaccume polarization as 2nd order reaction.Different reactions exist from that of perturbation theory.

(2)An elementary particle never can run through such vaccume field without any collision with particles of vaccume polarizations at anywhere!.Usually a collision of particle becomes a reaction.

In former interpretation,free running elemetary particle is considered without such fundamental reactios Telling fact,being free running particle in non-localized space is caused from higher order of such ones

Because an elementary particle never can run through such vaccume field without collision with particles of vaccume polarizations being supremely filled at anywhere!.The reaction is as follows.

(3) **Elementary Particle's Instantaneous Random Space Transportation(≡IRST=discontineous free running) Through Vaccume Polarization Dipole Chain Reactions=Free Particle's Tunneling Mechanism:**

d) **dipole chain reactions scheme:**

dipole creation

e^- $\{e^+\leftarrow e^-\}$ $\{e^+\leftarrow e^-\}$ $\{e^+\leftarrow e^-\}$ $\{e^+\leftarrow e^-\}$ $\{e^+\leftarrow e^-\}$ $\{e^+\leftarrow e^-\}$ $\{e^+\leftarrow e^-\}$ $\{e^+\leftarrow e^-\}$

⟶∗∗⟶∗⟶∗∗⟶∗⟶∗∗⟶∗⟶∗∗⟶∗⟶∗∗⟶∗⟶∗∗⟶∗⟶∗∗⟶∗⟶

↗ $\{e^+\ast e^-\}$ $\{e^+\ast e^-\}$ $\{e^+\ast e^-\}$ $\{e^+\ast e^-\}$ $\{e^+\ast e^-\}$ $\{e^+\ast e^-\}$ $\{e^+\ast e^-\}$ $\{e^+\ast e^-\}$ e^- ↖

free particle dipole anihilation ↗ free particle

e) RIST Feymann diagram:〈☞: quantum particle never has contineous trajectory,but discontineous one〉.

f) free particle's random instantaneous tunneling scheme:

e^- e^- =free particle

↗⟶ supremely chaotic vaccume polarization field ⟶

(4)Thus you will see that an elementary particle which is certainly dot being with zero volume simuletaneos-ly never be local being.but is non-localized being with random instantaneous space transportaion(=RIST) through chaotic vaccume polarization field with "definite memory of constant momentum" as a plane quantum wave function $\psi=\exp(px/i\hbar)$.ψ is of course an eigen function of momentum observable which is commutable with H_0.In addition to tell,such RIST is also possible for "any kind of complex particles" due to being of nucleon dipole forming reaction with FP gohst in general guage field theory(author).

(5)Quantum wave eigen function $\psi(x)$ of position variable is a reality.The statistical interpretaion of position observation on particle is due to such RIST of particle.Hence,in ψ(=state without observation on it),a particle can be two slits simuletaneously by RIST which itself is of course non-observable. Therefore RIST never contradict with low of upper limit of velocity of light in observable physics. In addition to tell,single electron can go thorugh "any N pieces of slits" simuletaneously.